



FIG. 1

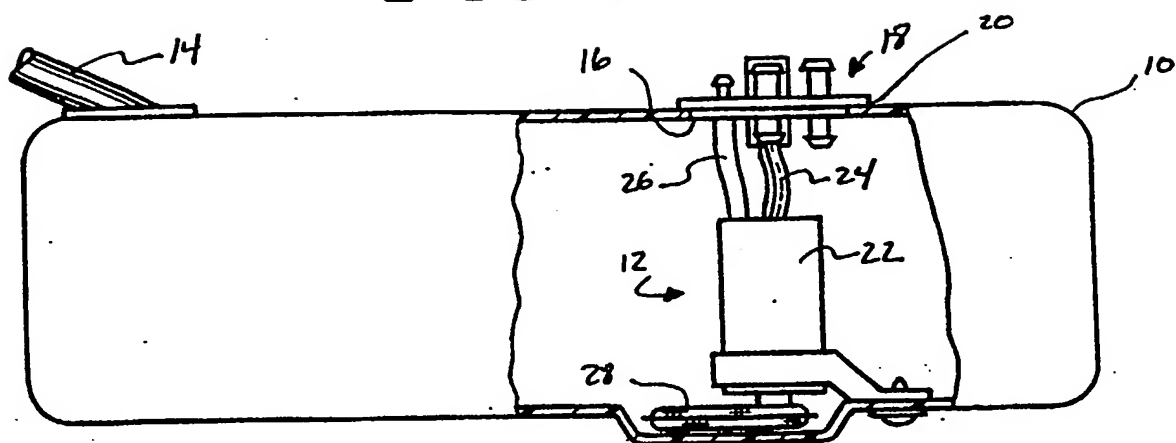


FIG. 2

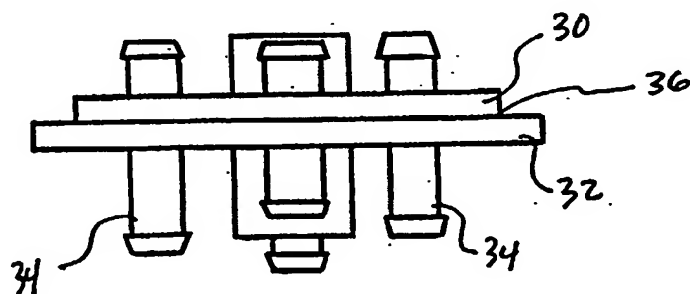
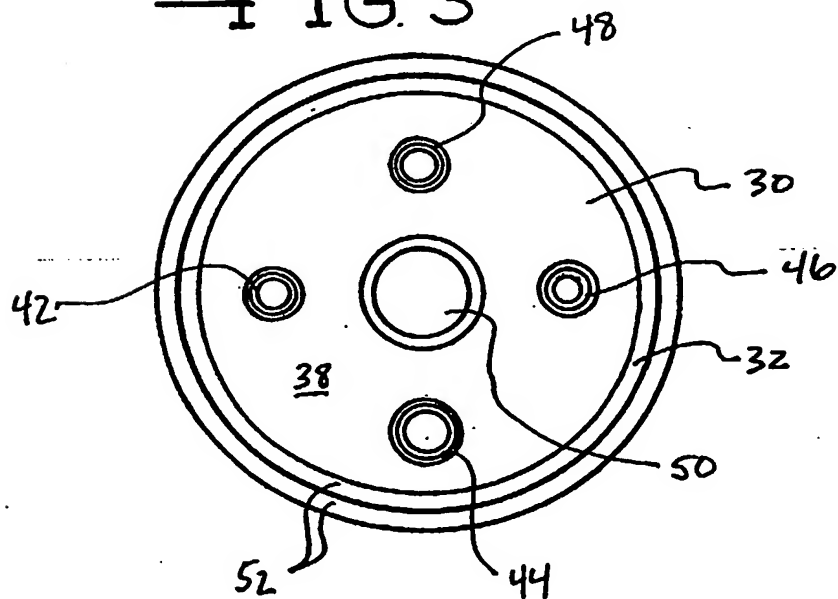
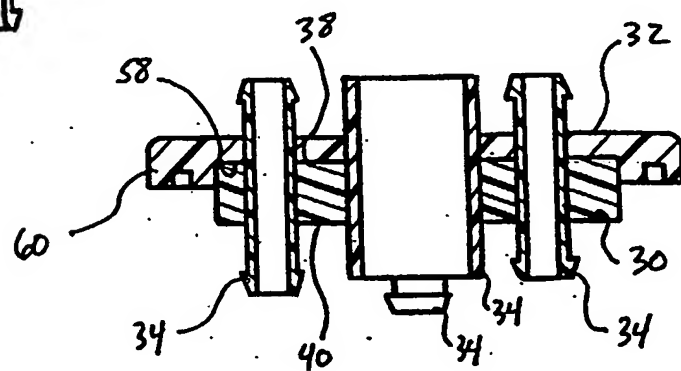
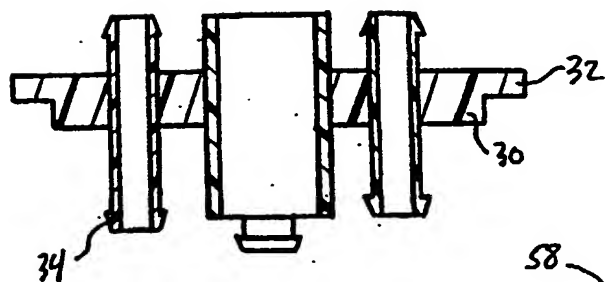
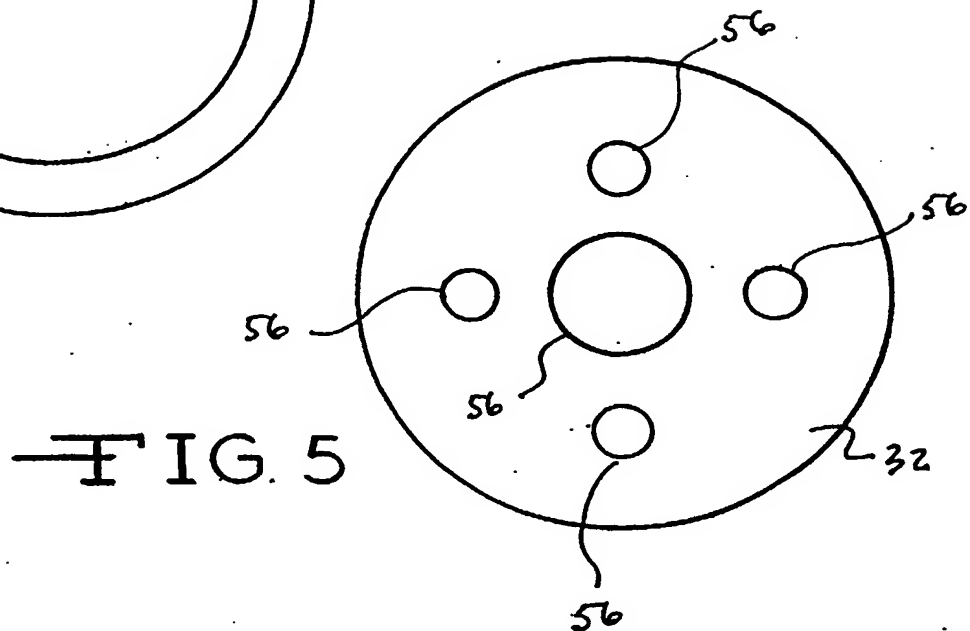
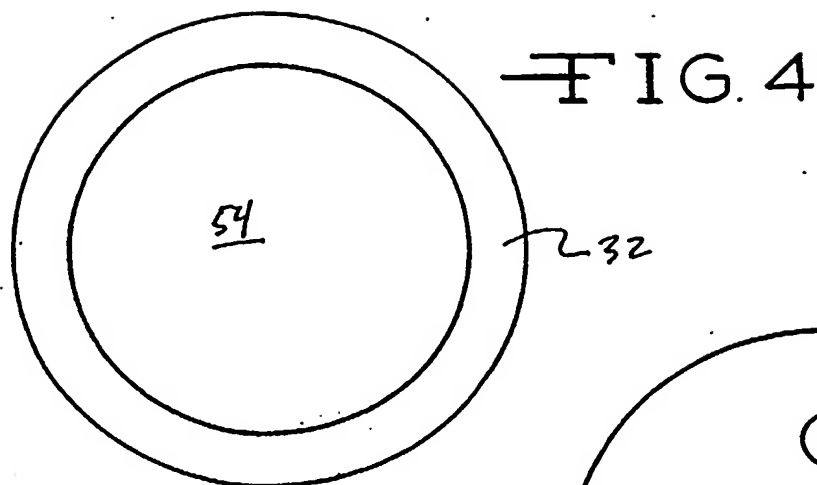


FIG. 3





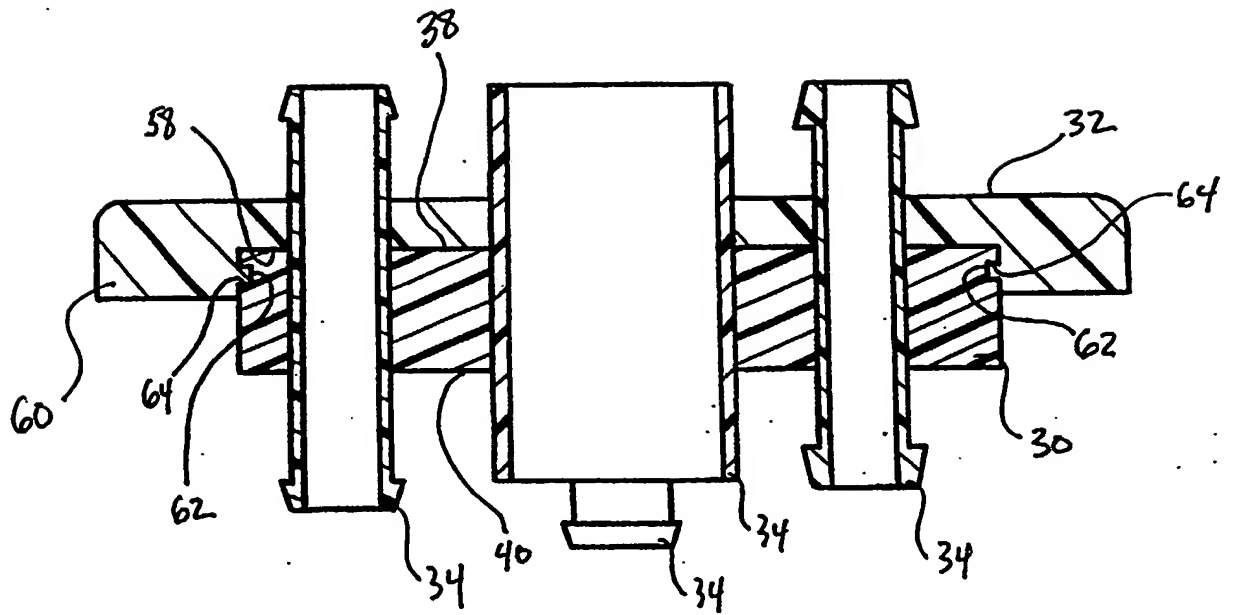


FIG. 6B

## PASSTHRU DEVICE FOR INTERNALIZED COMPONENT FUEL TANKS

## FIELD OF THE INVENTION

5 The present invention relates generally to a device that allows various elements to pass through the wall of a vehicle fuel tank and, more particularly, to a pass through device capable of being welded directly onto a wall of a polymeric vehicle fuel tank.

10

## BACKGROUND OF THE INVENTION

Modern automotive fuel tanks commonly have several critical components contained within their interior. For  
15 example, many fuel tanks in late-model vehicles typically contain a fuel pump and fuel filter disposed within the interior of the tank. This structure facilitates the modular approach to vehicle assembly currently being advocated by several automobile manufacturers.

20

The internalization of componentry, however, creates several issues regarding the structure of the fuel tank. For example, necessary communicative elements of the internalized components must pass through the wall of the  
25 fuel tank. An electric fuel pump requires an electrical supply line to provide the electricity needed for operation. As a consequence, this line must extend from the energy source, through the wall of the fuel tank, and to the fuel pump. Furthermore, the fuel pump forces fuel  
30 out of the tank and to the engine through a fuel supply

line. This line must therefore pass from the interior of the fuel tank, through the wall of the tank, and to the engine. Thus, at a minimum, an electrical connection and fuel line must pass through the wall of a fuel tank  
5 containing an internalized fuel pump. Depending on the arrangement and properties of the fuel tank and pump, other elements, such as fuel return lines and vapor lines, may also need to pass through the wall of the fuel tank.

10 Various means exist for providing the necessary conduit through which these communicative elements can pass. For example, some internal fuel pumps have flanges for mounting the base of the pump to a wall of the fuel tank. These flanges are typically secured to the tank via a  
15 secondary means of attachment, such as nut and bolt connections or have a threaded base that interacts with a threaded opening in the wall of the fuel tank, sometimes referred to as a Mason jar connection. With the various communicative elements disposed on the underside of the  
20 base of the pump, pass-through of the elements is achieved when the fuel pump is secured in place. Due to these secondary means of attachment, fuel pumps employing these technologies typically require the inclusion of a gasket element to ensure a complete seal between the wall of the  
25 fuel tank and the fuel pump. Also, the use of such secondary means of attachment typically increases the size of the pass-through portion due to the need to include space for nuts, threads and the like. This larger size necessitates a larger main opening in the fuel tank which  
30 provides more opportunity for hydrocarbon permeation.

The seal between any pass-through device and the wall of the tank presents an opportunity for permeation of hydrocarbons through the joint. For example, in a seal  
5 utilizing a secondary means of attachment and a gasket, the attachment means may, over time or abruptly, loosen, or the gasket may crack or split. In these situations, the advantages of a modular approach to assembly, e.g., savings of time and expense during manufacturing, may  
10 later be defeated by the need for repair or replacement.

It is known in the prior art to use fuel tanks made from polymeric materials, such as polyethylene, in automotive vehicles. These polymeric materials impart various  
15 advantageous features onto the fuel tank, including resistance to corrosion, flexibility in design, and decreased overall weight. Devices can be secured to these polymeric fuel tanks in a variety of ways, including via threaded connections and secondary means of attachments,  
20 as mentioned above. However, polymeric materials offer another advantage: weldability to similar materials. A weld joint between similar materials avoids the need for secondary means of attachment and provides a strong interface between the two objects.

25 Considering the above, a pass-through device designed specifically for polymeric fuel tanks will offer several advantages. For example, the device will provide the communicative paths that are necessary for internalized  
30 components, while allowing for a stronger joint, i.e., a

weld joint, by eliminating the need for a secondary means of attachment. Ultimately, such a device will enhance the operation of internalized component fuel tanks by lessening the opportunity for compromise of the seal  
5 between the tank and the pass-through. Also, such a device, appropriately composed, will reduce the ability of hydrocarbons to permeate through the joint between the device and the fuel tank.

#### 10 SUMMARY OF THE INVENTION

According to the invention there is provided a pass-through device for a polymeric fuel tank having internalized components, the pass-through device  
15 comprising:

a main body having an upper surface and a lower surface,

a mounting plate adjacent said main body and defining a circumferential ridge in conjunction with said main  
20 body,

at least one communicative passageway extending from said upper surface, completely through said main body to said lower surface,

whereby said pass-through device can be secured to  
25 the polymeric fuel tank by welding around said circumferential ridge.

The invention also provides a pass-through device for a polymeric fuel tank having internalized components, the  
30 pass-through device comprising:



a main body having an upper surface and a lower surface and defining a fuel supply line port and an electrical supply line port,

5 a mounting plate adjacent said main body, defining a plurality of openings and a circumferential ridge in conjunction with said main body.

whereby said pass-through device can be secured to the polymeric fuel tank by welding around said circumferential ridge.

10

The present invention provides a pass-through device for internalized component vehicle fuel tanks that takes advantage of the polymeric nature of most modern fuel tanks. At a minimum, the pass-through device contains a  
15 communicative passageway for the supply fuel line and a through opening for a push-through electrical connector. Also, the pass-through device may contain additional communicative passageway for elements such as fuel return lines and purge and fresh air inlets to a carbon canister.

20 The pass through device of the present invention comprises three components: a main body made of a barrier type material, such as nylon, a mounting plate of material similar to the material of the fuel tank, and at least one communicative passageway. Preferably, the mounting plate  
25 is composed of high density polyethylene. The main body is bonded to the mounting plate and may define the various communicative passageways. The nylon composition of the main body provides a barrier to hydrocarbon emissions, thereby lowering the permeation associated with the joint  
30 between the fuel tank and the pass-through device. The

mounting plate provides a circumferential surface for weldably connecting the pass-through device to a polymeric fuel tank. This allows the pass-through device to be directly welded to the wall of the fuel tank, providing a superior joint between the pass-through and the fuel tank, and eliminating the need for the use of a secondary means of attachment and/or gasket. As a consequence, the pass-through device can be made relatively smaller than pass-through members that utilize a secondary means of attachment. Therefore, the structure and composition of the pass-through device according to the present invention allows several communicative elements to pass through a relatively smaller opening in the wall of a polymeric fuel tank.

# BRIEF DESCRIPTION OF THE DRAWINGS

The invention will now be further described, by way of example, with reference to the accompanying drawings, in  
5 which:

Figure 1 is a side elevational view of a polymeric motor vehicle fuel tank with a portion broken away to reveal an internalized fuel pump assembly and a pass-through device according to the present invention;  
10

Figure 2, is an elevational view of a pass-through device according to the present invention;

Figure 3, is a top view of a pass-through device according to the present invention;  
15

Figure 4 is a schematic of a ring-shaped mounting plate according to the present invention;  
20

Figure 5 is a schematic of a circular-shaped mounting plate having a plurality of openings that correspond to the communicative passageways of the main body in accordance with the present invention;  
25

Figure 6 is an elevational view of a pass-through device including a mounting plate capped onto the main body in accordance with the present invention;

Figure 6a is an enlarged view of the interaction between the mounting plate and main body of the pass-through device of Figure 6; and

5        Figure 6b is an enlarged view of the mounting plate and main body of the pass-through device of Figure 6, showing structural features of the two components in accordance with the present invention.

#### 10    DETAILED DESCRIPTION OF THE INVENTION

Figure 1 illustrates a typical polymeric vehicle fuel tank 10 including an internalized fuel pump module 12. The fuel tank 10 is preferably blow molded plastic, and  
15 includes an inlet 14 or fill tube for the provision of vehicle fuel into the interior space of the fuel tank 10 from the exterior. The tank defines a main opening 16 for receiving the internalized fuel pump module 12 and any other internalized components. The pass-through device 18  
20 of the present invention closeably seals the main opening 16 of the fuel tank 10 via a circumferential weld joint 20 with the fuel tank 10.

The internalized fuel pump module 12 pumps vehicle fuel  
25 from the interior space of the fuel tank 10 to the engine of the vehicle. The fuel pump module 12 includes an electrical fuel pump 22 and an electrical supply line 24 that provides electrical energy from a power source external to the fuel tank 10. Also, the fuel pump module  
30 12 includes a fuel supply line 26 that carries fuel from

the fuel pump module 12, away from the fuel tank 10 and to the engine. The fuel pump module 12 may contain a fuel return line (not illustrated) and an associated in-tank fuel filter 28.

5

Various communicative elements can pass through the wall of the vehicle fuel tank 10. At a minimum, a fuel tank 10 with an internalized fuel pump module 12 has, as indicated above, an electrical supply line 24 and a fuel supply line 10 26 pass through its wall. If the vehicle does not have a returnless fuel delivery system, a fuel return line carrying excess fuel from the engine to the fuel tank 10 may also pass through the wall of the fuel tank 10. Furthermore, to balance pressure in the interior space of 15 the fuel tank 10 with external pressure, purge and vent ports may be necessary.

The pass through device 18 of the present invention comprises three primary components: a main body 30, a 20 mounting plate 32 and at least one communicative passageway 34. The main body 30 is bonded to the mounting plate 32, forming a circumferential ridge 36 between the two components 30, 32. The main body 30 preferably defines at least one communicative passageway 34 that can 25 take a variety of forms. Alternatively, the main body defines at least one aperture that can receive a separate assembly having one or more communicative passageways.

The main body 30 is preferably comprised of a heat and 30 fuel resistant material. Also, it is preferred that the

material serves as a barrier to the hydrocarbons typically found in vehicle fuel. That is, the material of the main body 30 of the pass-through device 18 inhibits the permeation of hydrocarbons. Preferably, the main body 30  
5 is comprised of nylon or other suitable barrier material.

As best shown in Figure 3, the main body 30 is preferably a circular shaped member defining an upper 38 and lower surface 40. Figure 1 illustrates a preferred size of the  
10 pass-through device 18 relative to the main opening 16 of the tank 10. The main body 30 preferably has a diameter slightly smaller than the diameter of the main opening 16 in the fuel tank 10. This allows the main body 30 to float in the main opening 16. The mounting plate 32, as  
15 will be further developed below, is slightly larger in size than the main opening 16, and therefore, when secured to the main body 30 and the fuel tank 10, prohibits the main body 30 from complete movement through the main opening 16. While this size and shape is preferred for  
20 the main body 30, it will be appreciated that the main body 30 can take on any size and/or shape as appropriate for the main opening 16 of the fuel tank 10 to which the pass-through device 18 is being secured.

25 The communicative passageway(s) 34, as will be more fully developed below, pass through the entire thickness of the main body 30, extending from the upper surface 38, through the main body 30 and through the lower surface 40. Preferably, the communicative passageway(s) 34 is disposed  
30 essentially perpendicular to the upper 38 and lower

surfaces 40 of the main body 30. Alternatively, the communicative passageway(s) 34 may extend through the main body 30 at any angle suitable for the particular element being passed through the wall of the vehicle fuel tank 10.

5

The communicative passageway(s) 34 serve as pass-throughs for individual communicative elements. At a minimum, the communicative passageways 34 preferably includes a fuel supply line port 44 42 that allows the fuel supply line 26  
10 to pass from the fuel pump 22 through the wall of the fuel tank 10, and toward the engine. Other ports, such as a fuel return line port 44, a vent port 46 and a purge port 48 may also be included. Also, an electrical supply port 50 may be present and allows the electrical supply line 24  
15 of the fuel pump 22 to pass from a power source, through the wall of the vehicle tank 10, and to the fuel pump 22. Furthermore, a separate fuel supply line port 44 may be present that allows additional fuel supply line to pass through the wall of the tank to a device, such as a  
20 supplementary generator.

The overall configuration of the communicative passageways 34 defined by the main body 30 will depend on the configuration of the internalized components within the  
25 fuel tank 10. In a preferred embodiment illustrated in Figure 3, the pass-through device 18 contains five communicative passageways 34: a fuel supply line port 42, a fuel return line port 44, a purge port 48, a vent port 46, and an electrical supply port 50. Preferably, the  
30 electrical supply port 50 is a centrally disposed,

circular opening defined by the main body 30. Also preferably, the remaining ports 42, 44, 46, 48 are arranged around the centrally-located electrical supply port 50. In this configuration, the centers of the fuel supply line port 42, fuel return line port 44, purge port 48 and vent port 46 are located equidistant from each other and from the centrally located electrical supply port 50. This arrangement allows for easy management of the various elements extending above and below the pass-through device 18. Alternatively, of course, all communicative passageway(s) 34 can be arranged in any fashion and pattern on the main body 30.

The communicative passageways 34 are preferably integrally formed by the main body 30. Alternatively, the main body 30 can define a plurality of openings for receiving communicative passageways 34 that constitute separate members or assemblies. In this embodiment, the communicative passageways 34 are disposed within the openings of the main body 30 and fixedly attached thereto by any suitable means, such as welding.

The communicative passageway(s) 34 can take on a variety of forms and sizes, depending on the configuration and size of the various communicative elements that must pass through the wall of the fuel tank 10 in which the pass-through device is being utilized. For example, the electrical supply line port 50 is preferably a push-through connector. This connector comprises a polymer plug molded around electrical conductors for the purpose of



supplying electrical energy to internal components of the fuel tank 10 assembly. Also, the fuel supply line port 42 and fuel return line port 44, if present, may include quick connect features on one or both sides of the main  
5 body to facilitate rapid connection and disconnection of fuel supply and return lines. These connections preferably conform to SAE J405 specifications for fuel line disconnects. Other forms that the communicative  
10 passageways 34 can take include simple barbed projections for retaining a tube or hose, threaded openings and/or projections, or any other suitable form.

Preferably, the mounting plate 32 is composed of the same polymeric material used to form the vehicle fuel tank 10.  
15 This correlation of materials assures that a strong weld joint is created between the mounting plate 32 and the fuel tank 10. Due to the prevalence of polyethylene as a material used in the manufacturing of blow-molded vehicle fuel tanks, it is preferred that the mounting plate 32 is  
20 formed of polyethylene. It will be appreciated that the mounting plate 32 can be comprised of any polymeric material or mixture of polymeric materials that will allow for creation of a weld joint between the mounting plate 32 and a polymeric vehicle fuel tank 10. Alternatively, the  
25 mounting plate 32 can be comprised of any suitable material.

The mounting plate 32 is preferably a circular member. It will be appreciated by those skilled in the art, however,  
30 that any shape suitable for providing the necessary base

for the main body 30 and having the necessary shape and surface onto which a weld joint with the fuel tank 10 can be formed will suffice. As best illustrated in Figures 2 and 3, the mounting plate 32 preferably defines a flat  
5 circumferential ridge 36 around its outer perimeter when associated with the main body 30 of the pass-through device 18. Preferably, the mounting plate 32 is a flat circular member having a diameter slightly larger than the diameter of the main opening 16 in the vehicle fuel tank  
10 10. When bonded together, the mounting plate 32 forms the circumferential ridge 36 with the main body 30.

Alternatively, as depicted in Figure 3, the mounting plate can be a circular member that defines a plurality of  
15 progressively larger shoulders 52 on its outer perimeter. This embodiment allows the pass-through device 18 to have several progressively larger shoulders 52 available for the weld joint. This configuration will enable the pass-through device 18 to be useful in a variety of vehicle  
20 fuel tanks having main openings of varying sizes. In this embodiment, the mounting plate 32 still forms the circumferential ridge 36 with the main body 30.

As shown in Figure 4, the mounting plate 32 can be a ring-  
25 shaped member. In this configuration, the mounting plate 32 defines an inner hole 54 that allows the communicative passageway(s) 34 to pass through the hole 54. Alternatively, as illustrated in Figure 5, the mounting plate 32 can define a plurality of openings 56 that  
30 correspond in location and size to the communicative

passageway(s) 34 of the main body 30. In this configuration, the communicative passageway(s) 34 are simply passed through the respective openings 56 in the mounting plate 32, and the mounting plate 32 is then  
5 bonded to the main body 30.

As illustrated in Figure 2, the mounting plate 32 can define a flat, continuous surface for bonding to the main body 30. In this configuration, the mounting plate 32  
10 simply sits adjacent the main body 30, and a bond is formed between the adjacent surfaces of the two components 30, 32. Alternatively, as depicted in Figure 6, the mounting plate 32 can be integrated with the main body 30. Also alternatively, as illustrated in figures 6A and 6B,  
15 the mounting plate 32 can define a recess that receives a surface of the main body 30. The recess 58 is deep enough to accommodate at least a portion of the overall height of the main body 30. Also, in this embodiment, the mounting plate 32 defines a circumferential cap 60 that extends  
20 beyond the depth of the recess 58 and assists in retaining the main body 30 adjacent the mounting plate 32 by compressive force. As shown in Figure 6B, the cap 60 may define locking or retaining means, such as a lip 62 or plurality of lips, that interact with corresponding  
25 features, such as a groove 64, on the edge of the main body 30. In this configuration, the cap 60 may be used as the sole means for maintaining the mounting plate 32 adjacent the main body 30, or the mounting plate 32 can be bonded to the main body 30 on the junction areas between

the recess 58 and the mounting plate 32 and/or between the caps 60 and the perimeter of the main body 30.

A weld is preferably formed between the circumferential ridge and the surface of the vehicle fuel tank 10 while the pass-through device is situated in the main opening of the vehicle fuel tank 10. The weld provides a seal between the vehicle fuel tank 10 and the pass-through device.

10

The foregoing disclosure is the best mode devised by the inventors for practicing the invention. It is apparent, however, that pass through devices for internalized component fuel tanks incorporating modifications and variations may be conceivable to one skilled in the art of vehicle fuel tanks and their components. Inasmuch as the foregoing disclosure is intended to enable one skilled in the pertinent art to practice the instant invention, it should not be construed to be limited thereby but should be construed to include such aforementioned variations and be limited only by the scope of the following claims:

15  
20

CLAIMS

1. A pass-through device for a polymeric fuel tank having internalized components, the pass-through device  
5 comprising:  
    a main body having an upper surface and a lower surface,  
    a mounting plate adjacent said main body and defining a circumferential ridge in conjunction with said main  
10 body,  
    at least one communicative passageway extending from said upper surface, completely through said main body to said lower surface,  
    whereby said pass-through device can be secured to  
15 the polymeric fuel tank by welding around said circumferential ridge.
2. The pass-through device of claim 1, wherein said main  
20 body is composed of nylon.
3. The pass-through device of claim 1 or claim 2, wherein said mounting plate is composed of polyethylene.
4. The pass-through device of any preceding claim,  
25 wherein said communicative passageway is integrally formed by said main body.
5. The pass-through device of any preceding claim, wherein said main body further defines at least one opening and said communicative passageway comprises a

separate conduit member disposed within said at least one opening and fixedly attached to said main body.

6. The pass-through device of any preceding claim,  
5 wherein said at least one communicative passageway is a fuel supply line port.

7. The pass-through device of any preceding claim,  
wherein said mounting plate comprises a circular ring defining a central opening.

10 8. The pass-through device of any preceding claim,  
wherein said mounting plate comprises a circular member defining a plurality of openings.

9. The pass-through device of any preceding claim,  
wherein said mounting plate comprises a circular member  
15 defining a recess and a circumferential cap.

10. The pass-through device of claim 9, wherein said main body further defines a groove and said circumferential cap defines at least one projecting lip,

whereby said groove and said projecting lip interact  
20 to retain said mounting plate adjacent said main body.

11. The pass-through device of any preceding claim,  
wherein at least one end of said communicative passageway defines quick connect features.

12. The pass-through device of claim 11, wherein said quick connect features conform to SAE J405 specifications for fuel line disconnects.

5 13. A pass-through device for a polymeric fuel tank having internalized components, the pass-through device comprising:

a main body having an upper surface and a lower surface and defining a fuel supply line port and an  
10 electrical supply line port,

a mounting plate adjacent said main body, defining a plurality of openings and a circumferential ridge in conjunction with said main body.

whereby said pass-through device can be secured to  
15 the polymeric fuel tank by welding around said circumferential ridge.

14. The pass-through device of claim 13, wherein said electrical supply port comprises a push-through connector.

15. The pass-through device of claim 13 or claim 14, wherein said mounting plate comprises a circular ring  
20 defining a central opening.

16. The pass-through device of any of claims 13 to 15, wherein said mounting plate comprises a circular member defining a plurality of openings.

17. The pass-through device of any of claims 13 to 16, wherein said mounting plate comprises a circular member defining a recess and a circumferential cap.

5 18. The pass-through device of claim 17, wherein said main body further defines a groove and said circumferential cap defines at least one projecting lip, whereby said groove and said projecting lip interact to retain said mounting plate adjacent said main body.

10

19. A pass through device substantially as herein described, with reference to or as shown in the accompanying drawings.

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INVESTOR IN PEOPLE

Application No: GB 0215086.0  
Claims searched: 1 - 19

Examiner: Tom Sutherland  
Date of search: 7 October 2002

## Patents Act 1977 Search Report under Section 17

### Databases searched:

UK Patent Office collections, including GB, EP, WO & US patent specifications, in:

UK Cl (Ed.T): B7H (HLK, HLX)

Int Cl (Ed.7): B60K

Other: Online: WPI, EPODOC, JAPIO

### Documents considered to be relevant:

Category	Identity of document and relevant passage	Relevant to claims
X	GB 2328659 A (UNISIA JECS) See Figs 1, 4 and 10 and page 5 lines 2 to 4, page 6 lines 10 to 12.	1, 13, 19
X	GB 2284581 A (ROVER) See Fig. 4 and page 4 line 21.	1, 13, 19
X	DE 4229717 A (PORSCHE) See abstract and Fig.	1, 3, 13, 19

X Document indicating lack of novelty or inventive step  
Y Document indicating lack of inventive step if combined with one or more other documents of same category.  
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A Document indicating technological background and/or state of the art.  
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E Patent document published on or after, but with priority date earlier than, the filing date of this application.